Old Orchard Beach Quadrangle, Maine

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Funding for the preparation of this map was provided by the Maine Geological Survey.

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Open-File No. 03-96
2003

This map accompanied by a 7 p. report.

On the geologic map, different bedrock units are indicated by colors and identified by letter symbols that represent their assigned age and unit name. The following description summarizes the major rock types of each unit and gives a simplified geologic history by which they formed.

GEOGRAPHY

The Old Orchard Beach quadrangle lies close to the northern end of the Maine coastal zone marked by extensive sand beaches. Old Orchard Beach, a part of the arcuate series of beaches bordering Saco Bay, occupies the very southeastern corner of the quadrangle (Photo 1). The land is underlain by late-glacial outwash sand, dune sand, and marine clay. Outcrops are not abundant, but bedrock lies close to the surface in many parts of the quadrangle and is commonly encountered in shallow excavations. Drainage is poorly developed and is characterized by many nearly right angle bends, suggesting control by bedrock jointing, another indication of the shallow nature of drift in the area.

MAJOR ROCK TYPES

The stratified, or layered, rocks of the Old Orchard Beach quadrangle are all metamorphic rocks, including schist, phyllite, and granofels. Schist consists mostly of thin, flat flakes of mica which are arranged parallel to each other such that the rock splits into thin sheets. Phyllite has a similar mineral texture except the individual grains are very small and not readily seen without a microscope. Granofels, made up primarily of the minerals quartz and feldspar, has a grainy texure somewhat like sugar. In contrast with schist and phyllite, granofels tends to break into angular blocks or chunks. Varieties of schist and granofels may be further distinguished by their particular mineral content, grain size, color, or other characteristics.

ORIGIN OF THE STRATIFIED ROCKS

The oldest rocks of the Old Orchard Beach quadrangle belong to the Casco Bay Group, a diverse assortment of metamorphosed volcanic rocks, shales, and limestone, deposited during Ordovician time (see Geologic Time Scale, below). Within this quadrangle the oldest rock of the Casco Bay Group exposed at the surface is the Spring Point Formation consisting of crudely layered basaltic volcanic ash (Photo 2). These rocks formed as hot lava erupted on an ancient ocean floor and became fragmented on contact with the cold ocean water. As volcanic activity ended, sulfidic shale of the Scarboro Formation (Photo 3) accumulated in thin beds conformably on top of the volcanic pile.

The Merrimack Group is represented in the Old Orchard Beach quadrangle by the Eliot Formation, a sequence of slightly metamorphosed calcareous siltstone and shale (Photo 4); and the Kittery Formation, consisting of thin to medium-bedded metamorphosed feldspathic sandstone and shale (Photo 5). These rocks are interpreted to be deep ocean sediments deposited during Late Ordovician to Early Silurian time. Similar rocks northwest of the Nonesuch River fault, the Berwick Formation, accumulated in a deep ocean environment during the same time interval.

DEFORMATION, METAMORPHISM, FAULTING AND IGNEOUS INTRUSION

Early in the Devonian Period, in an episode of crustal compression referred to as the Acadian orogeny, the sedimentary rocks of the quadrangle were extensively folded and broken by a major thrust fault. The rocks that were pushed down into the Earth's crust during this compressional event were metamorphosed; shale was transformed into phyllite and schist, siltstones and sandstones into granofels, and fine basaltic ash into green phyllite. At about the same time gabbro magma intruded into these metamorphosed sedimentary rocks, forming the Saco pluton (Photo 6). Shortly after the Acadian orogeny, the sedimentary rocks and the metagabbro/diorite of the Saco pluton were extensively sheared during a period of right-lateral faulting that formed the Norumbega fault zone of which the Broad Cove fault is interpreted to be a branch. Most prominently affected by this shearing were the phyllites of the Eliot and Scarboro Formations (Photo 7). Later, during the Mesozoic Era, the rocks were broken by high-angle faults (Nonesuch River and Johns Point). The Nonesuch River fault is well expressed as a linear depression occupied by the Nonesuch River (Photo 8), along which rocks of the Eliot Formation are contorted and extensively injected by milky quartz veins (Photo 9).

Photo 1. Old Orchard Beach, looking south. Dark patch in the middle ground is an outcrop of the Kittery Formation.

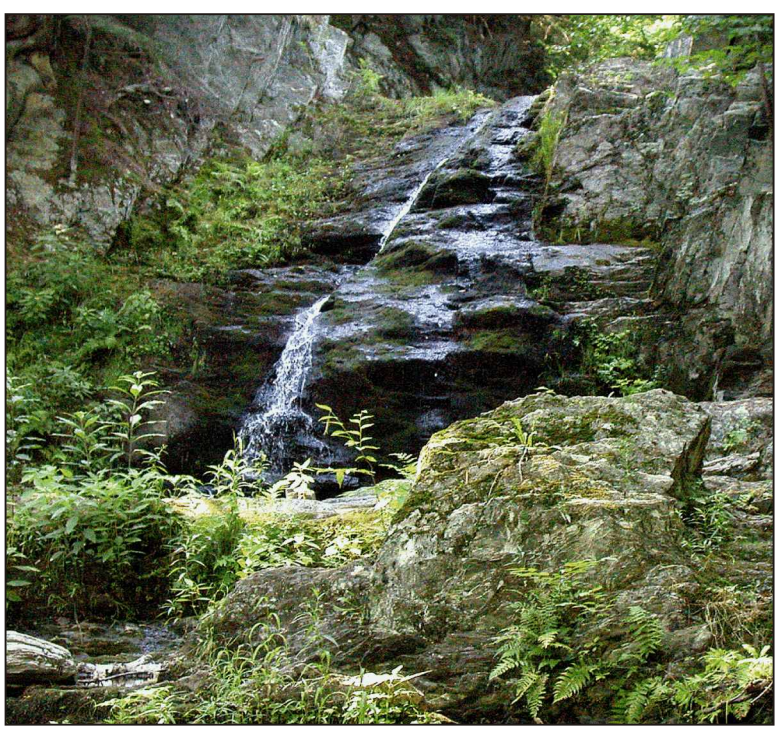

Photo 2. Spring Point Formation exposed at Cascade Falls on the Cascade River, Saco.

Photo 3. Black graphitic phyllite of the Scarboro Formation exposed in excavation near Slater Hill, Saco.

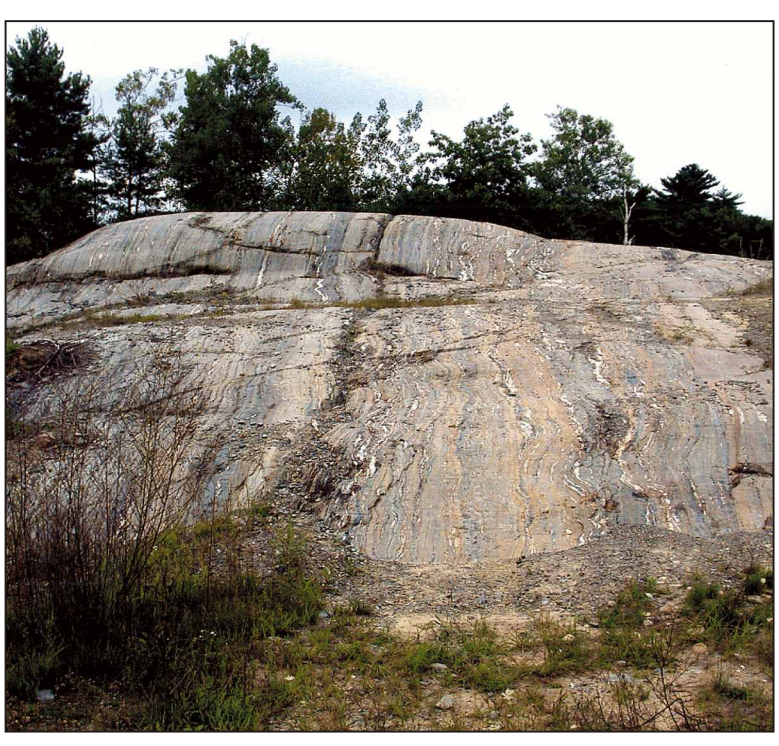

Photo 4. Glacially smoothed exposure of the Eliot Formation in a gravel pit near the Maine Turnpike in Saco.

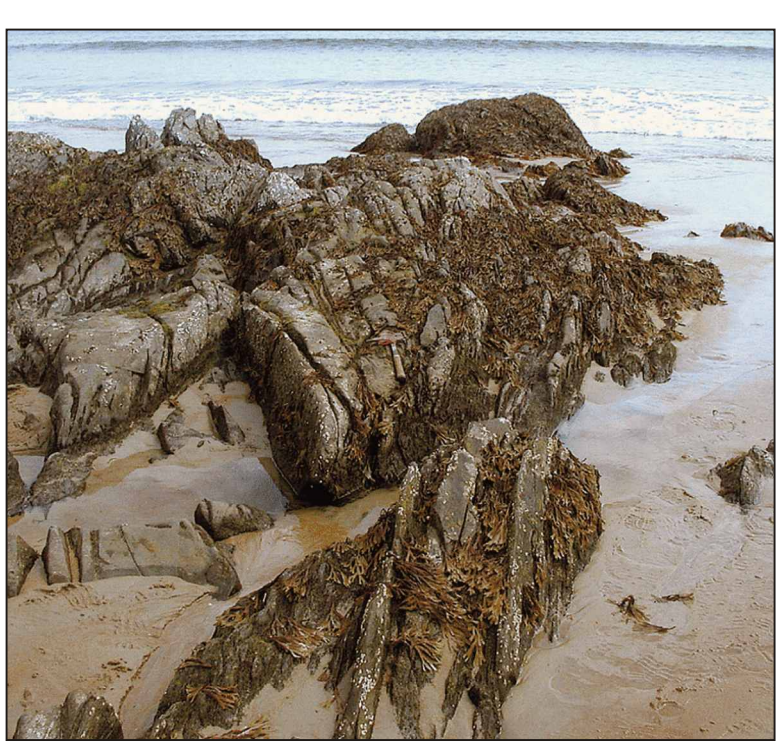

Photo 5. Close-up of the outcrop of the Kittery Formation on the intertidal zone of Old Orchard Beach, seen in Figure 1.

Photo 6. Metagabbro/diorite of the Saco pluton exposed in road cut along Maine Route 5, Saco. Patches of green epidote may represent digested xenoliths of Eliot Formation.

Photo 7. Sheared bedding of the Eliot Formation exposed in glaciated outcrop in large gravel pit on the west side of Maine Route 5, Saco.

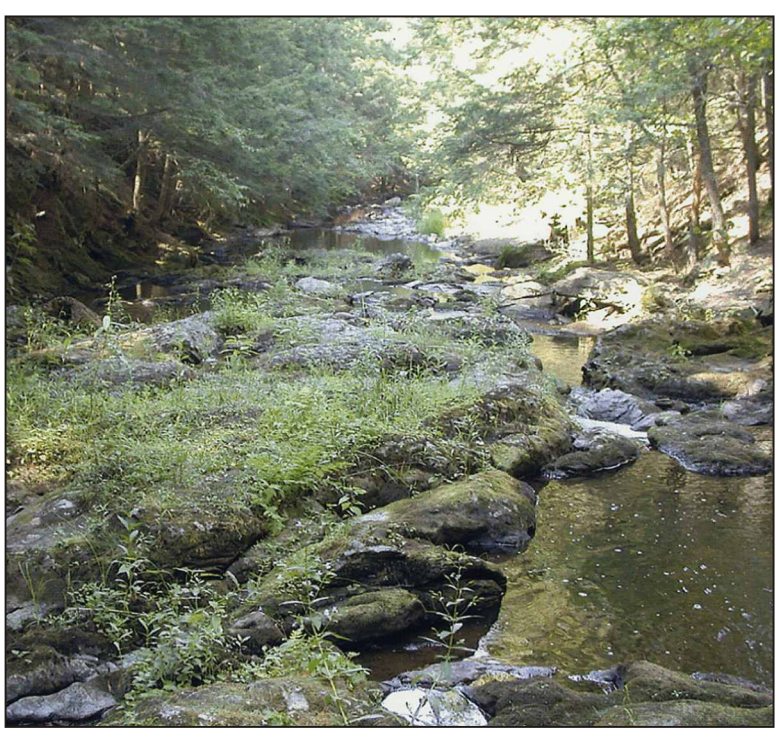

Photo 8. Straight course of the Nonesuch River along the trace of the Nonesuch River fault, 400 feet downstream of Watson Mill Road bridge, Saco.

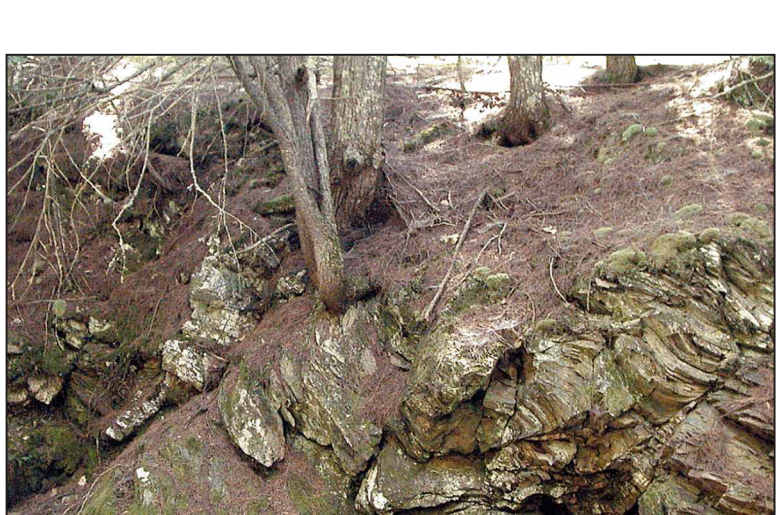

Photo 9. Milky quartz veins and contorted cleavage of the Eliot Formation along the Nonesuch River at same locality as Photo 8.

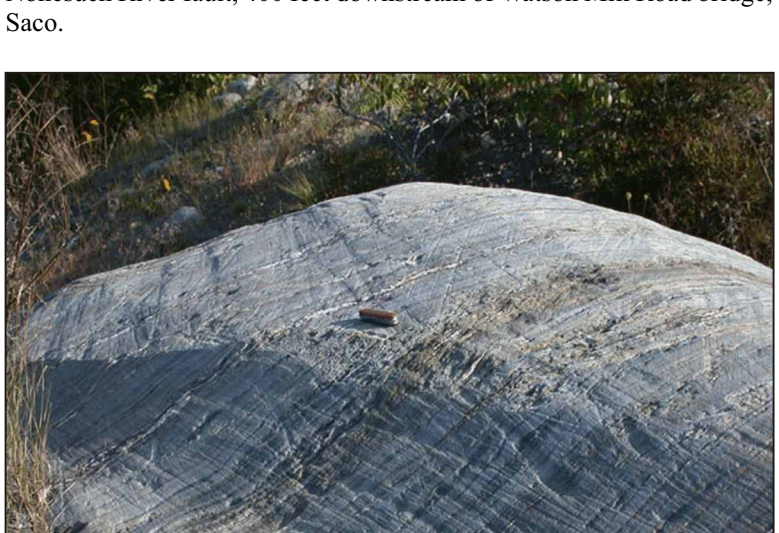

Photo 10. Glacial striations on outcrop of the Eliot Formation in a gravel pit near the Maine Turnpike in Saco.